

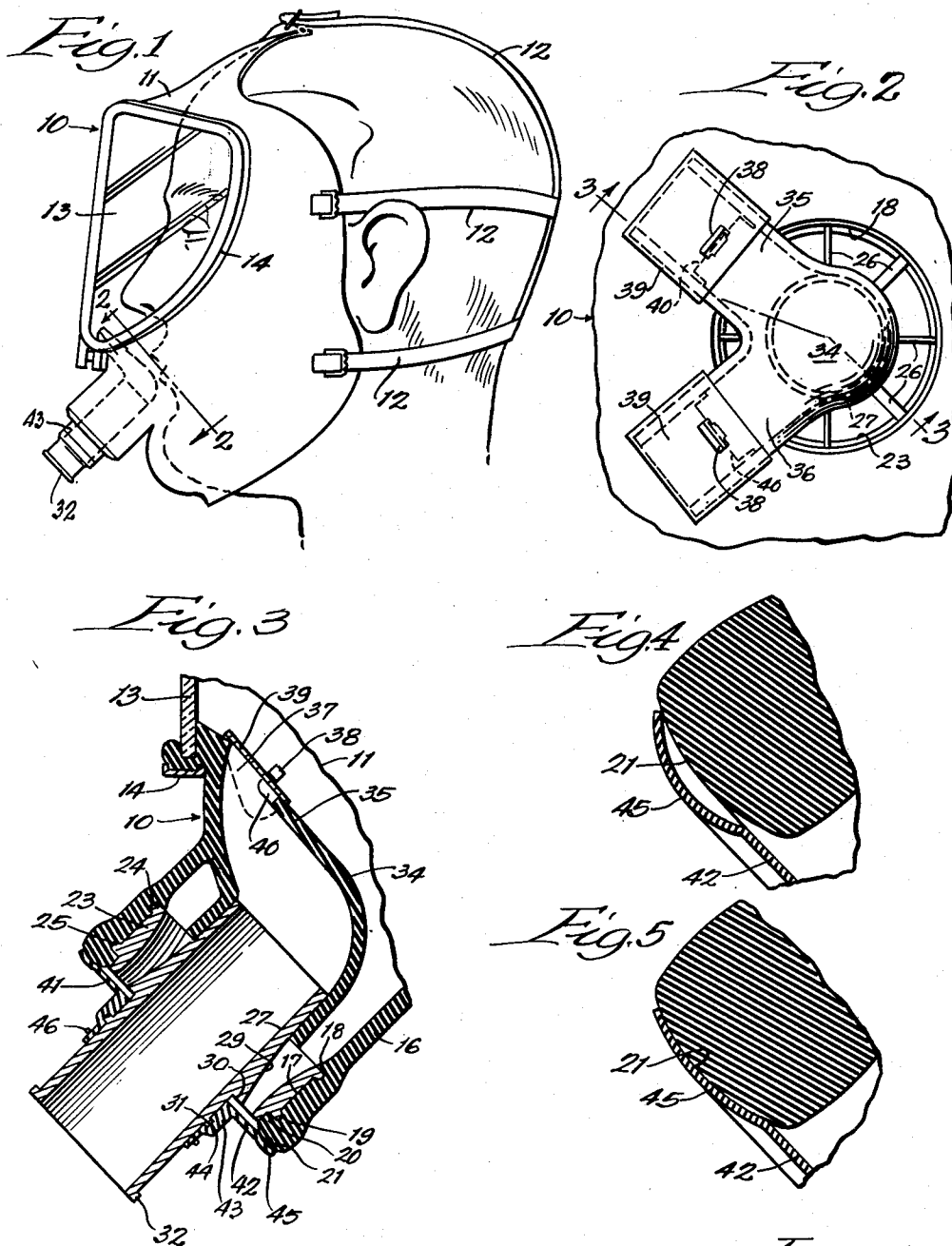
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EXHAUST VALVE FOR GAS MASKS

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EXHAUST VALVE FOR GAS MASKS

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This invention is directed to improvements in exhaust valves for gas masks and in this respect is an improvement over my copending application Serial No. 729,951, filed February 21, 1947, now Patent No. 2,588,516.

The principal object of this invention is to provide an improved exhaust valve for a gas mask wherein tight seating of the exhaust valve is assured during inhalation but permitting free and easy exhaust of air during exhalation. In this connection the gas mask is provided with an exhaust passage terminating in an annular seat having a convex seating surface, and a flexible diaphragm having a concave seating surface for engaging the convex seating surface controls the exhaust passage. Preferably the free radius of the concave seating surface is less than the radius of the convex seating surface, so that during inhalation first the edge of the diaphragm engages the annular seat, then the remainder thereof to provide a positive surface seal. Due to the relatively great concavity of the seating surface of the diaphragm, the outer edge thereof will not be flexed out of contact with the annular seat during inhalation, and surface to surface sealing is thereby assured. During exhalation, first the inner portion of the diaphragm is moved from the annular seat and then the remainder, this being aided by the relatively great concavity of the diaphragm seating surface, to provide free and easy exhaust of air.

Further objects of this invention reside in the details of construction of and of the cooperative relationship between the component parts forming the exhaust valve for the gas mask.

Other objects and advantages will become apparent to those skilled in the art upon reference to the accompanying specification, claims and drawing, in which—

Fig. 1 illustrates the gas mask applied to the face of the wearer;

Fig. 2 is a partial view of the interior of the gas mask taken substantially along the line 2—2 of Fig. 1;

Fig. 3 is a partial vertical sectional view taken substantially along the line 3—3 of Fig. 2;

Fig. 4 is an enlarged partial sectional view through a portion of the exhaust valve with the diaphragm in substantially free position; and

Fig. 5 is a view similar to Fig. 4 but showing the diaphragm seated during inhalation.

Referring first to Fig. 1, the gas mask is generally designated at 10 and it includes a face portion 11 for snugly fitting over the face of the wearer. The face portion may be provided with

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a plurality of buckles for receiving straps 12 for securing the face portion to the face of the wearer. The gas mask is also provided with a pair of lenses or windows 13 which are held in place in the face portion 11 by means of rims 14. The face portion 11 of the gas mask may be suitably molded from rubber or similar material.

The face portion 11 of the gas mask is formed with a cylindrical extension 16 having an opening 17 therein, which opening is in alignment with the nose and mouth of the wearer. This cylindrical opening 17 is provided with an internal shoulder 18, an internal groove 19, and an internal shoulder 20. The exterior end of the cylindrical extension 16 is provided with a valve seat surface 21 which accordingly is located at the exterior end of the cylindrical opening 17. The annular valve seat surface 21 is convex in cross section to provide a convex seating surface.

A metallic sleeve 23 is located within the cylindrical opening 17 and is provided with a pair of shoulders 24 and 25 for securely retaining the sleeve within the cylindrical opening 17 and for accurately positioning the sleeve therein. In this respect, the shoulder 24 cooperates with the shoulder 18 and the shoulder 25 cooperates with the groove 19 and the shoulder 20, whereby movement of the sleeve 23 in the opening 17 is prevented after the sleeve has been inserted therein. Because the extension 16 is made of rubber or like material, the sleeve 23 may be readily inserted in the opening 17 and is maintained in the proper position therein. The sleeve 23 is provided with webs 26 for carrying a tube 27 internally thereof and in spaced relation thereto in order to provide an air supply passage internally of the tube 27 and an air exhaust passage between the tube 27 and the sleeve 23.

Preferably, the tube 27 is rigidly or integrally secured to the webs 26 which, in turn, are rigidly or integrally secured to the sleeve 23 whereby the position of the tube 27 is fixed with respect to the sleeve 23 and hence to the annular valve seat 21.

The exterior of the tube 27 adjacent the sleeve 23 is flared outwardly as indicated at 29 to provide a shoulder 30 and to direct the exhaust air outwardly. The tube 27 is also provided with a shoulder 31, and a shoulder 32 operates to assist in the securing of the conventional flexible air supply tube to the tube 27.

The inner end of the tube 27 is received in an

air inlet passage 34 which communicates with a pair of inlet passages 35 and 36 which, in turn, are provided with air inlet openings 37 adjacent the lenses or windows 13. Preferably, the air inlet passages 34, 35 and 36 are molded in the face portion 11 of the gas mask to form an integral construction. The air inlet passages 35 and 36 are provided with integral tongues 38 which are received in slots formed in scoop-type dead air check valves 39. The tongues 38 are formed on extensions 40 of the top walls of the inlet passages 35 and 36, and the scoop-type dead air check valves 39 overlie the slits at the sides of the extensions 40. The dead air check valves operate to control the openings 37 and pivot freely at the extensions 40. The scoop-type dead air check valves 39 open toward the lenses or windows 13 so that when the check valves 37 are opened, the air supply is directed against the windows or lenses 13 to prevent fogging of the same.

A diaphragm exhaust valve is designated at 41 and includes a diaphragm or disc portion 42 and a sleeve portion 43. Preferably the diaphragm valve is preformed from rubber or similar material so that it is entirely flexible. The interior of the sleeve portion 43 of the diaphragm valve is provided with a groove 44. The diaphragm valve 42 is located on the tube 27 and the inner face thereof engages the shoulder 30 and the groove 44 engages the shoulder 31 so that the diaphragm valve is securely retained on the tube 27 and is accurately positioned with respect to the valve seat 21. The outer part of the valve portion 42 of the diaphragm valve is concave in formation, as indicated at 45, so that when the diaphragm valve is moved against the convex seat 21, the outer edge of the diaphragm valve first engages the seat and then the remainder thereof engages the seat as illustrated in Figs. 4 and 5. The free radius of the concave seating surface of the diaphragm valve is less than the radius of the convex seating surface 21, as illustrated in Fig. 4. Due to these differences in radius, the outer edge of the diaphragm will not be flexed out of contact with the valve seat 21 during inhalation and surface to surface sealing during inhalation is thereby assured. If desired, a ring 46 may clamp the outer end of the sleeve portion 43 of the diaphragm valve to the tube 27.

In the operation of the gas mask, when the wearer inhales, the diaphragm valve 41 is closed to seal the exhaust air passage and the dead air check valves 39 are opened to admit air to the gas mask. This action of the valve is caused by reduced air pressure within the gas mask. Upon exhalation, the dead air check valves 39 are closed and the diaphragm exhaust valve 41 is opened to exhaust air from the gas mask. This operation of the valve is caused by an increase in air pressure within the gas mask. In the operation of the dead air check valves 39, they pivot freely about the extensions 40. In the operation of the diaphragm exhaust valve 41 there is a general flexing action throughout the entire diaphragm portion 42 thereof and due to the concave shape 45 of the outer part of the diaphragm exhaust valve the edge first engages the convex seat 21 during the closing operation and then the remainder thereof engages and during the opening operation the edge is the last to leave the seat 21. There is thus provided a progressive sealing and unsealing action as the diaphragm exhaust valve is closed and opened and during the inhalation period there is a positive surface

to surface seal with the entire concave portion 45 of the diaphragm engaging the convex surface 21 of the seat.

The opening 17 in the gas mask being in alignment with the nose and mouth of the wearer operates to provide direct air supply to and air exhaust from the nose and mouth of the wearer. Also, the air exhaust passage around the tube 27 provides for an automatic drain of sputum from the gas mask, the sputum automatically draining out past the exhaust valve. The exhaust valve being of diaphragm construction operates as a diaphragm for voice transmission purposes.

If the tension of the diaphragm is not proper for easy and effective operation thereof, then the tension may be changed by substituting a new tube and sleeve assembly in the cylindrical opening 17, which new assembly may have a slightly different spacing of the shoulders 30 and 31. In this way the position of the sleeve portion 43 of the diaphragm valve may be predetermined with respect to the position of the seat 21 for obtaining predetermined tension in the diaphragm exhaust valve. The tension of the diaphragm may also be determined by substituting different diaphragm valves of slightly different dimensions.

It will be noted that the rubber diaphragm valve fits against the rubber seat 21 and by the engagement of rubber against rubber, an extremely effective seal is provided. If desired, the diaphragm valve may be protected by an encircling guard, not shown.

While for purposes of illustration one form of this invention has been disclosed, other forms thereof may become apparent to those skilled in the art upon reference to this disclosure, and, therefore, this invention is to be limited only by the scope of the appended claims and the prior art.

I claim as my invention:

1. An exhaust valve structure for controlling the exhaust outlet of a gas mask, comprising a tubular member providing an annular valve seat having a convex seating surface around the outer end of said tubular member, and a flexible, resilient diaphragm valve extending across the outer end of said tubular member in coacting relationship with said valve seat, said diaphragm valve having a supported central portion, an intermediate flexing portion, and a peripheral portion providing an annular concave seating surface facing said convex seating surface, the outer edge of said concave seating surface normally resting against the outer portion of said convex seating surface in sealing relation therewith and the remainder of said concave seating surface normally being spaced from said convex seating surface to permit said diaphragm valve to be displaced from said valve seat by a minimal rise in pressure above atmospheric pressure within said exhaust outlet, said concave seating surface normally having a greater degree of curvature than said convex seating surface and arranged so that upon a decrease in pressure below atmospheric pressure within said exhaust outlet said concave seating surface pivots on its outer edge against said convex seating surface and is progressively wrapped around said convex seating surface by the inward flexing of the intermediate portion of said diaphragm valve, whereby the outer edge of said concave seating surface exhibits a hooking action with respect to said convex valve seat.

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2. An exhaust valve structure for a gas mask, comprising a tubular member providing an exhaust passage terminating in an annular seat having an outwardly oriented convex seating surface, and a flexible resilient diaphragm valve extending across said passage in coacting relationship with said valve seat, said diaphragm valve having a fixedly supported central portion, an intermediate flexing portion, and a peripheral portion adjacent said valve seat providing an annular concave seating surface, the outer edge of said concave seating surface resting against the outer portion of said convex seating surface and said intermediate flexing portion being disposed in a plane substantially perpendicular to the longitudinal axis of said tubular member and aligned with said convex seating surface when the pressure is substantially the same on both sides of said diaphragm valve, the remainder of said concave seating surface under said pressure conditions being spaced from said convex seating surface to permit said diaphragm valve to be displaced from said valve seat by a slight increase in pressure above atmospheric pressure within said exhaust passage, the free radius of the concave seating surface being less than the radius of the convex seating surface, said diaphragm valve being arranged so that upon a

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decrease in pressure below atmospheric pressure within said exhaust passage said convex seating surface pivots on its outer edge against said convex seating surface and is progressively wrapped around said convex seating surface by the inward flexing of the intermediate portion of said diaphragm valve, whereby the outer edge of said concave seating surface exhibits a hooking action with respect to said convex valve seat.

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